ABSTRACT OF THE INVENTION

The present invention describes a technique for achieving high peak power output in a laser employing single-stage, multi-pass amplification. High gain is achieved by employing a very small "seed" beam diameter in gain medium, and maintaining the small beam diameter for multiple high-gain pre-amplification passes through a pumped gain medium, then leading the beam out of the amplifier cavity, changing the beam diameter and sending it back to the amplifier cavity for additional, high-power amplification passes through the gain medium. In these power amplification passes, the beam diameter in gain medium is increased and carefully matched to the pump laser's beam diameter for high efficiency extraction of energy from the pumped gain medium. A method of "grooming" the beam by means of a far-field spatial filter in the process of changing the beam size within the single-stage amplifier is also described.

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